PROCESS FOR PRODUCING RFID LABELS

SPECIFICATION

The invention pertains to a process for producing RFID labels according to the introductory clauses of claims 1 and 12.

Prior Art

The invention describes various processes for producing RFID (Radio Frequency Identification) labels, also called "smart labels". The basis of intelligent labels (RFIDs, smart labels) is so-called transponder technology. Its great advantage lies in the wireless link between the label and the reader. This can greatly accelerate the mechanical process of data acquisition, because the reader no longer needs to be linked optically with the label. Thus, for example, the content of a box or of a whole pallet can be acquired without error. Security codes can also be stored in the smart labels, as a result of which packages cannot be falsified (e.g., pharmaceutical industry), and thefts can be clearly identified.

A system for wireless identification consists of two components: the RFID label (smart label), which is attached to the merchandise, and the read/write device, which can be used to read data from or to transfer data to the label. Depending on their design, the transponders store data ranging from simple identification numbers to complex sets of data (e.g., expiration date, production site and date, sale prices, etc.). Measurement data can also be stored. A transponder usually consists of an integrated

circuit, an antenna, and other passive components. Depending on the way in which power is supplied, a distinction is made between active and passive transponders. If the label has its own power supply in the form of, for example, a battery, we speak of an active system. If the transponder is supplied with power by means of an external magnetic or electric field, the system is considered passive.

The transponder IC, which is connected to the antenna of the mobile data storage medium, handles the transmission and reception of the data. In the case of passive RFID transponders, all of the intelligence and functionality are usually integrated in this circuit.

Some types also contain an on-chip resonance capacitor for an oscillating circuit, so that no other external components are required except for an antenna coil. The capacitor or capacitors required can also be produced by printing methods. Known, standard processes for the production of RFID labels include the lamination of a coated foil onto the label, the printing of the antenna by the screen printing method, and production by means of ink-jet printing.

Merchandise security labels, such as the RFID labels described above, can be applied directly to the merchandise, to its packaging, or to the external packaging for the shipment of the merchandise. Accordingly, they are almost always located on the outside of a package and can be damaged by mechanical stress. This damage is to be prevented to the greatest extent possible. This process should be related to the production and subsequent transport of the product.

Object of the Invention

The object of the present invention is to apply the required parts to a label in a simple way and preferably also to protect the chip and, if possible, the antenna from mechanical damage.

This object is accomplished by the characterizing features of claims 1 and 12 in conjunction with claim 25. Elaborations of the invention can be derived from the various subclaims.

Examples

According to the invention, at least parts of the antenna and/or of the oscillating circuit which are required for the proper functioning of the device are applied to the substrate by offset printing, or at least part of the functionally required antenna and oscillating circuit are applied directly or indirectly by means of a letterpress plate. After printing, the only further step required is to attach the chip, which does not usually have a housing, by means of a bonding or soldering process. Therefore, it is especially advantageous if the area in which the chip is to be attached is lowered by a shaping operation after printing and before the application of the chip. This makes it possible to realize lowering of the chip as well as a guide function during the application. It is also possible to lower the entire area of the label afterwards.

With respect to the design of the antenna, the following parameters are of interest: the inductance, the coil area, the ohmic (active) resistance, and the mutual capacitance between the windings. Deviations from the characteristic values can make it impossible for contact to be established between the read/write device and the

transponder. The resonance frequency must also be achieved with a high level of accuracy, which means that very strict standards are imposed on the quality of the printing.

According to the invention, a metal ink or conductive paste is transferred via a waterless offset plate or a wet offset plate and via the printing blanket to the substrate within a sheet-fed or rotary web offset press. The printed lines form the antenna and possibly the entire oscillating circuit. The chip is then soldered or glued on later, if necessary. The substrate, on which the components of the oscillating circuit are printed, can be a fibrous material (paper, nonwoven, etc.), a fabric of natural or synthetic fibers, or a plastic film.

An absorbent substrate, e.g., paper or some other fibrous material, can be pretreated to prevent the conductive ink or paste from being absorbed. The pretreatment can involve pre-inking or the application of printer's varnish by means of a flexo press or an offset press. It is also possible to laminate a film onto the back of the label or to have the back of the label pretreated by the manufacturer. If a large amount of ink is absorbed by the substrate, the inductance can change as a result of the third plane. Application by means of a plate for waterless printing is preferred over wet offset, because the wetting agent required for wet offset printing can lead to corrosion of the ink. The precision of the printing is also higher. Waterless offset also makes it possible to obtain higher resolutions and finer lines.

The capacitor required to produce the oscillating circuit can be obtained by printing two lines closely together, which are connected to each other at the ends of the shorter line. Alternatively, the base line can be printed first; an insulating material is

printed on top of it; and then the opposing line is printed on top of that in a third printing couple. The capacitor can also be integrated into the chip. Other circuit elements such as resistors can also be printed by tapering the thickness of the lines.

In theory, the capacitor lines can be printed on both sides of the substrate so that they are opposite each other. For this purpose, it is also necessary to perforate the substrate beforehand so that a connection is established between the two opposing lines when the ink is applied.

Finally, the antenna and the oscillating circuit can be coated with a protective coating, which protects the printed image against mechanical, chemical, and oxidative damage. Alternatively, a protective film can be applied over them.

According to a second process, an adhesive is preprinted by passing it through a printing couple. The sheet printed with the adhesive is then brought into contact with a transfer film, which has been coated with a metallic or other conductive material. At the points where the adhesive has been applied, the conductive material is separated from the carrier film and transferred to the substrate. This then forms the oscillating circuit, antenna, or certain parts of these components.

According to a third process, the lines of the antenna and/or of the oscillating circuit can be printed by means of a flexo press. The disadvantage of this, however, is that a flexo plate can lead to blurred edges if it is not positioned precisely. These blurred edges would change the capacitance and thus cause a change in the characteristics of the oscillating circuit.

To be able to label the merchandise with an RFID label, on the one hand, and to protect the RFID label from damage, on the other hand, the following process is proposed:

1. The antenna and possibly other components of the oscillating circuit are applied by one of the specified printing methods, as described above. This can be accomplished by offset printing, by direct or indirect letterpress printing on a deformable substrate.

2. A recess, a groove, or an impression in the substrate is then made in a stamping or grooving machine, which, in a preferred embodiment, is located within the printing press. The recess is intended for subsequently receiving a bar-shaped or rectangular or square chip. The forming can also be carried out in a separate stamping machine during the stamping-out operation or in the folder-gluer. The recess should be sufficiently deep that the surface of the chip or of the component that contains the oscillating circuit is flush with the surface of the substrate. It is also possible for the surface of the chip to lie somewhat lower than the surface of the substrate.

3. After the recess has been made, the chip or oscillating circuit is applied and joined with the conductive track or the antenna by a soldering or adhesive bonding process. The conductive track of the antenna or of the oscillating circuit must be elastic or flexible to the extent that it undergoes deformation of the magnitude required for the production of the recess. In this connection, the surface of the substrate will also bend in the vicinity of the antenna or conductive track.

Figures 1 to 3 show the arrangement of the RFID label with antenna and oscillating circuit.

This process provides several advantages. An unprotected chip or even a chip enclosed in a protective covering is thus better protected from mechanical stress. Packages are placed directly side by side in their shipping packages or on warehouse shelves. Therefore, they can rub against each other. This poses the risk of mechanical damage of the oscillating circuits or chips and antennas. The recessed arrangement protects the oscillating circuit or chip and antenna from this type of mechanical damage. Another advantage of the recess is that it provides a positioning aid during the mounting of the chip.

Alternatively, the entire oscillating circuit, including the chip, can be applied to the substrate. In an additional step of the process, the entire RFID label can then be sunk by a stamp in such a way that the RFID label can no longer be damaged by mechanical influences or rubbing.